DEPARTMENT OF GEOLOGY

MODULE CODE	**GLG1B10**
MODULE NAME	**OPTICAL AND ANALYTICAL MINERALOGY**
CAMPUS	**APK**
EXAM	**DECEMBER 2015**

Date	**December 2015**
Assessor(S)	**Mr Mike de Villiers**
Internal Moderator	**Mr Mike Knoper**
External Moderator	
Duration	**180 minutes**
Marks	**180**

Number of pages	**5 (including front page)**
Instructions	**Answer all the questions**

GLG1B10 Optical and Analytical Mineralogy Supplementary Exam Questions 2015

Section A: Optical Mineralogy (90 marks)

Question 1

Give the characteristics of the upper and lower polars on a microscope **(6 marks)**

Question 2

(a) Spinel, turquoise and orthoclase belong to which crystal systems? Graphically explain these systems and clearly state what the relationships are between the lengths of the axes and the angles in-between them **(15 marks)**

(b) How is the Miller Index for a crystal face found? **(3 marks)**

Question 3

(a) What is the electromagnetic theory? **(4 marks)**

(b) Give the equation for the refractive index, and state what each symbol represents **(5 marks)**

Question 4

(a) With regards to bonding forces, how do isotropic and anisotropic minerals differ? **(2 marks)**

(b) Give the ray velocity surface for a $1V^-$ mineral **(4 marks)**

(c) What is the gypsum plate? **(4 marks)**

Question 5

(a) Mineral identification indicates that a mineral is 1V-. Draw the optic figure, indicating the quadrants, and their respective colours and signs. Explain what is occurring in the figure in order for it to be a 1V- mineral **(7 marks)**

(b) Give the definition of an optic axis **(4 marks)**

(c) Give an explanation of a flash figure **(8 marks)**

Question 6

(a) Draw the indicatrix of a 2V- mineral. Indicate all the axes and the refractive indices, as well as the 2V angle. Indicate what BXO and BXA is **(10 marks)**

(b) What is an acute bisectrix figure? **(4 marks)**

Question 7

Briefly explain pericline twinning **(6 marks)**

Question 8

(a) What is the main difference between pyroxenes and amphiboles? **(2 marks)**

(b) Which 2 pyroxene minerals have the highest pleochroism? **(2 marks)**

(c) Give the name of the amphibole minerals that have the optic sign and angle below **(4 marks)**

(1) 2V+; 70 - 90°

(2) 2V-; 52 – 85°

(3) 2V+; > 90°

(4) 2V-; 0 - 68°

Section B: Analytical Mineralogy (90 marks)

Question 1

Describe, in detail, the 3 types of mineral diaphaneity **(9 marks)**

Question 2

Indicate to which Family and Group each of the following minerals come from. Give the chemical formula and Si:O ratio of each mineral, and provide one example of a rock where the mineral commonly occurs **(36 marks)**

(a) Tephroite

(b) Uvarovite

(c) Lawsonite

(d) Elbaite

(e) Diopside

(f) Anthophyllite

Question 3

(a) In the presence of CO_2, brucite reacts to form which mineral? Provide the chemical equation **(5 marks)**

Question 4

Draw the stability conditions graph for the aluminium silicate polymorphs **(5 marks)**

Question 5

In which facies does epidote occur, and what minerals is it commonly associated with (**5 marks)**

Question 6

Name the 3 orthopyroxene minerals, and give their chemical formula **(6 marks)**

Question 7

Where do tremolite, actinolite and riebecktite occur? **(3 marks)**

Question 8

(a) State the 2 groups that the phyllosilicates are divided into, and give their characteristics, as well as 2 mineral examples **(10 marks)**

(b) Give the 2 different types of serpentine minerals and state the difference between the two **(4 marks)**

Question 9

Draw a one-component phase diagram system **(7 marks)**